

# Modelling Sustainable Systems and Semantic Web

## Modelling of Conceptual Worlds

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for Master Computer Science

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## **Procedural knowledge → Practical procedures (Von Verfahrenswissen zu Verfahrensweisen)**

- ▶ Correspondence between the coherence of the language form and the coherence of practices.
- ▶ Establishing coherent practices as procedures allows to substantiate predicates. “At the beginning of the school lesson the sandwiches have to be packed away”. Normative sentences are possible only after such a transposition of the predicate to the subject position.
- ▶ Parallels to the concert example in the first lecture.
- ▶ *Processual knowledge* is the description form, *practical procedures* are the embodiment.

# The Linked Open Data Cloud

## Back to the basic idea.

- ▶ This creates a globally networked **decentralised open database**, the Linked Open Data Cloud, in which all **public** information is freely and machine-readable available.
  - ▶ The collection of data is reversed. Data is nothing private but part of a world built around a core stock of **publicly available information** in a **public domain** as an essential cultural constituent.
  - ▶ See <http://lod-cloud.net/>
  - ▶ Growing the LOD Cloud:  
<http://lod-cloud.net/versions/>
- ▶ The context of Industry 4.0 and all major data projects including Google is not conceivable without these efforts.
- ▶ Basis for internal and inter-company information systems such as ERP and CRM.

# Namespaces and Conceptual Worlds

Communication is made possible through the introduction of **namespaces** supported as a URI prefix.

Namespaces allow to generate URIs without overlapping.

- ▶ This can be used to generate descriptions that contain the shortcuts of speaking about MY world, MY concepts, I-core, worlds and reality, construction of reality, without having to transcend MY context mentally.
- ▶ But we want more: cooperation with specific others.
- ▶ Semantics = pragmatically contextualised **formation of models** as a basis for *common practical procedures*.
- ▶ Language is required to *speak about the models themselves*, and thus ways of formalising semantics are required, too.

# Conceptualisations and Conceptual Worlds

## But: **The Tower of Babel Phenomenon**

- ▶ What does it mean that every communicative context along with his own practical procedures develops also his own models and speaks his own language?
- ▶ Which concepts can support translation services?
- ▶ **Ontologies** (or vocabularies): WE agree on the usage of common namespaces (foaf, skos, org, sioc etc.) for *special* purposes and thus on common *partial models* of the world.
  - ▶ Phenomenon of coherence between private and cooperative language practices.
- ▶ How does that work exactly?
  - ▶ **Content:** Pragmatically contextualised formation of *models* as basis for common *practical procedures*.
  - ▶ **Form:** *Ontologisation* as pragmatically contextualised semantification of syntax.
  - ▶ Examples on the next slide.

# Conceptualisations and Conceptual Worlds

## Example foaf: Friend of a Friend

- ▶ foaf: `<http://xmlns.com/foaf/0.1/>`
- ▶ Redirect to `http://xmlns.com/foaf/spec/`
- ▶ We study the model developed there and the descriptions of semantics and syntax.

## Example skos: Simple Knowledge Organisation System

- ▶ skos: `<http://www.w3.org/2004/02/skos/core#>`
- ▶ Forwards to a tabular overview `https://www.w3.org/2009/08/skos-reference/skos.html`.
- ▶ At the very bottom of the page three references with more detailed explanations about semantics.

# Conceptualisations and Conceptual Worlds

## Example org: The Organisation Ontology

- ▶ `org: <http://www.w3.org/ns/org#>`
- ▶ Forwards to a turtle file. Download and inspect it.
- ▶ `rdfs:seeAlso <https://www.w3.org/TR/vocab-org/>`

A socially extremely difficult process, but that is **the core of semantic technologies**: The *institutionalisation* of machine-readable common conceptual worlds as *social process*.

# Conceptualisations and Conceptual Worlds

Associated with this are *formation of models*, conditionalities (contextuality of different realities) and the process of transcending contexts if ontologies are not applied as originally intended.

- ▶ Talk to each other – agree on ontologies.
- ▶ Further development of ontologies.
- ▶ Large databases of ontologies: <http://prefix.cc> or <http://lov.okfn.org> (Linked Open Vocabularies)
- ▶ Creativity in a cooperative context. Requirement of formalisation to exchange information as data. Again the concert example.



# Conceptualisations and Conceptual Worlds

Example: DBPedia – extract structured information from Wikipedia

- ▶ DBpedia is a crowd-sourced community effort to extract structured information from Wikipedia and make this information available on the Web. ... We hope that this work will make it easier for the huge amount of information in Wikipedia to be used in some new interesting ways. ...
- ▶ Example: <http://dbpedia.org/page/Leipzig>

# Conceptualisations and Conceptual Worlds

Example: Linked data service of the German National Library

- ▶ The German National Library offers a linked data service for long-term use of the entire national bibliographic data including all norm data by the Semantic Web Community. Offering this data service it endeavors to make a contribution to the worldwide information infrastructure as a prerequisite for modern commercial and non-commercial web services.
- ▶ <http://www.dnb.de/lds>

## Schema.org

- ▶ Other approach: <http://schema.org> – Google's ontologisation of the world and incorporation into websites instead of building a distributed database as the Linked Open Data Cloud.
- ▶ Schema.org and Microdata:  
<https://schema.org/docs/gs.html>.
  - ▶ itemscope, itemtype and itemprop and the link to RDF.
- ▶ Labeling websites with this markup increases their visibility on Google.

## Google's Knowledge Graph

**Google's Knowledge Vault:** Extracted facts by supervised learning from the examined websites as Google's knowledge base.

- ▶ Per 2014 it contained over 1.6 billion facts. Facts were assessed with a probabilistic confidence value.

**Google Knowledge Graph:** Consolidation and enrichment with structured facts from Freebase (founded in 2007, 2010 bought by Google), Wikipedia and Wikidata.

- ▶ Contained over 70 billion facts per 2016.
- ▶ At the end of 2015, the Google Knowledge Graph API was published. Web developer can use it to access the stock of data.

## Other Approaches

But that is only a part of the **Giant Global Graph** (Tim Berners-Lee, 2007).

### Wolfram Alpha

Also a *search engine* that is based on facts from own collection of data. Uses Mathematica as additional *compute engine* to create more complex presentations and visualisations.

The goal is to network mathematical knowledge and general knowledge.

- ▶ <https://www.wolframalpha.com>
- ▶ Example "Leipzig".